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NOTHNAGEL, Joseph, Leo [US/US]; 211 Tanager  
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Tabin & Flannery, 120 South LaSalle Street, Suite 1600,  
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- (71) Applicant (*for all designated States except US*): EAST-  
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- (72) Inventors; and
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D. [US/US]; 323 Tower Hill Drive, St. Charles, IL 60175  
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(54) Title: STABLE AQUEOUS POLYMER DISPERSIONS AND FORMULATIONS WITH LATEX POLYMERS TO FORM WATERBORNE COATINGS

(57) Abstract: The present invention relates to stable aqueous alkyd polymer dispersins and blends of those dispersins with latexes. The blend of alkyd dispersion and latex polymer is effective for providing a primer coating with superior humidity and salt spray resistance, low VOC levels, very fast dry times, early water spotting resistance and block resistance, and excellent application properties.

## STABLE AQUEOUS POLYMER DISPERSIONS AND FORMULATIONS WITH LATEX POLYMERS TO FORM WATERBORNE COATINGS

The present invention relates to stable aqueous polymer  
5 dispersions and blends of those dispersions with latexes.  
More particularly, aqueous alkyd polymer dispersions are  
prepared by forming polymer salts in a hydrophilic organic  
solvent and removing the hydrophilic organic solvent from a  
solvent blend of water and the hydrophilic organic solvent  
10 at temperatures which minimize the mean particle size of the  
polymers in the resulting aqueous dispersions of the  
polymers and/or removing the organic solvent from the  
polymer/organic solvent/water blend such that inversions do  
not occur. The alkyd polymer dispersions are blended with a  
15 latex to form a waterborne coating with improved properties.

### BACKGROUND OF THE INVENTION

Protective and decorative coatings based on alkyd  
20 polymers have been traditionally used in many applications  
because they provide a wide range of strength, flexibility,  
toughness, adhesion, degradation resistance and other film  
properties. Many are solution polymers because they are  
prepared and applied as solutions of organic polymers in  
25 organic solvents.

Environmental concern over the use of organic solvents  
has become increasingly important to the coating industry.  
This concern not only extends to preservation of the  
environment for its own sake, but extends to public safety  
30 as to both living and working conditions. Volatile organic  
emissions resulting from coating compositions which are  
applied and used by industry and by the consuming public are  
not only often unpleasant, but also contribute to  
photochemical smog. Governments have established  
35 regulations setting forth guidelines relating to volatile

organic compounds (VOCs) which may be released to the atmosphere. The U.S. Environmental Protection Agency (EPA) established guidelines limiting the amount of VOCs released to the atmosphere, such guidelines being scheduled for  
5 adoption or having been adopted by various states of the United States. Guidelines relating to VOCs, such as those of the EPA, and environmental concerns are particularly pertinent to the paint and coating industry which uses organic solvents that are emitted into the atmosphere.

10 The use of aqueous dispersions of polymeric vehicles, or alternatively, solventborne high solids polymeric vehicles are two general approaches that have been used to reduce VOCs in coating compositions. Previous approaches for conventional aqueous systems have limited the molecular  
15 weights of the polymers used in the polymeric vehicle, which limits the impact resistance and other properties of the coating binders and films resulting from the polymeric vehicles.

One process for the preparation of aqueous polymer  
20 dispersions is emulsification in which hydrophilic assistants (emulsifiers and/or protective colloids) are used in order to ensure the stability of the dispersion. These assistants can make the films produced from the dispersions somewhat sensitive to water.

25 Another way to disperse polymers in water is to use ionic components in the polymeric vehicle. One approach is to make a polymer such as an alkyd having carboxyl groups, or other ionizable groups and acid number in amounts effective such that when the carboxyl groups are converted  
30 into salts with a neutralizer such as an amine, they will permit the polymer or oligomer to be dispersed in a mixed solvent system which includes an organic solvent and water. The salt, such as an amine salt, of the oligomer or polymer disperses into the mixed water/organic solvent system with  
35 the formulation of a dispersion or solution. This is commonly known as a water reducible system. These systems commonly have high acid values.

Organic solvent has typically been removed from water reducible systems through two routes. The first route utilizes low temperature boiling solvents that are water miscible and often form low temperature boiling azeotropes with water. These types of processes result in the loss of neutralizer and require addition of make-up neutralizer in the process. Further, use of insufficient solvent in these systems results in the polymer salt being insoluble with addition of water. Hence, an inversion takes place as solvent is stripped from the system.

The second route typically utilizes organic solvents that boil at temperatures greater than 100°C. and also often form azeotropes with water. Distillation proceeds at higher temperatures which, if the salt is an amine, will result in loss of amine, cause undesirable particle size variation in the dispersion and undesirably increase the average particle size of the resin in the dispersion. If distillation continues too long and too much amine is stripped, the dispersion will become unstable and fall apart.

To keep viscosities low, in some water reducible systems molecular weights of polymers have been kept low. As a result, these systems have required large amounts of cross-linker and cross-linking to achieve coatings performance. The use of higher molecular weight polymers in water reducible systems often results in unacceptably high processing viscosities due to the inversion from water in oil to oil in water. In addition, removal of water and solvent results in loss of neutralizer as described above, destabilization of the dispersion and undesirable large resin particle size.

Traditionally, carboxyl functional polymers, such as alkyds, are supplied to the paint formulator as water-reducible resins (e.g., McWhorter Technologies's Duramac® WR 74-7495), which consist of low molecular weight resins (1,500-4,000) with acid numbers of 35-60, provided at 60-80% solids in water miscible solvents (e.g., butoxy ethanol, sec-butyl alcohol). The paint formulator neutralizes the

carboxyl groups with a volatile amine to form water soluble salts and disperses the resin in water. The resin entangles and collapses into large agglomerates and is then formulated into the final paint. The stability of the resin once  
5 dispersed in water is 2-4 weeks at 120°F. at which time changes may be observed in viscosity, pH shift (due to hydrolysis of the resin), seeds and separation. The finished paints are typically 25% volume solids at a pH of 8.5. The final pH is critical for the stability of these  
10 systems, as excess amine is required to keep these agglomerates in a dispersed phase.

Due to the desire to reduce the impact of volatile organic solvent emissions on the environment, paint formulators have desired technologies that utilize lower  
15 levels of VOC. Conventional solventborne resins range from 4.5 to 6.0 lbs VOC per gallon, high solids solventborne resins from 2.3 (bakes) to 4.0 lbs VOC per gallon, water-reducible resins hover around 2.8 lbs VOC per gallon, and latex at 0-1.8 lbs VOC per gallon. However, each technology  
20 suffers from one or more deficiencies when compared to conventional solventborne alkyds.

#### SUMMARY OF THE INVENTION

The present invention is directed to an aqueous blend  
25 of an alkyd dispersion and a latex polymer which forms coatings. In an important aspect, the blend provides an air dried coating. In another aspect, the blend is effective for providing an air dried primer that is recoatable with a wide range of topcoats. In an important aspect of the  
30 invention, the blend of alkyd dispersion and latex polymer is effective for providing a primer coating with superior humidity and salt spray resistance, low VOC levels, very fast dry times, early water spotting resistance and block resistance, and excellent application properties.

35 The blend of the present invention provides synergistic effects in film coating performance as compared to films formed from alkyd dispersions or latex polymers alone. For

example, coatings made with alkyd dispersions alone wet out metal substrates, and demonstrate conventional alkyd-like properties such as good chemical resistance and good salt spray corrosion resistance. However, coatings made with alkyd dispersions alone exhibit blistering when exposed to constant humidity, have slow dry times, and have poor block and poor early water resistance. Further, coatings made with latex alone demonstrate fast dry times, good block resistance, and higher volume solids, but have poor early water resistance. Traditionally, latex coatings can be formulated to have good salt spray corrosion resistance or good humidity resistance, but not both.

In an important aspect, the alkyd dispersion/latex blend of the present invention is effective for providing desirable properties of both alkyds and latexes. The coatings of the present invention are made by blending about 10 weight percent to about 60 weight percent, based on the total resin solids of the blend, of latex with an alkyd dispersion, and in a very important aspect, about 30 weight percent to about 50 weight percent, based on the total resin solids of the blend, of a latex is blended with an alkyd dispersion. The alkyd dispersion/latex blend of the present invention is effective for providing a film coating with a humidity resistance of at least about 336 hours, an air dry time of about 10 to about 40 minutes at about 25°C, and a salt spray corrosion resistance of at least about 336 hours. In an important aspect, the air dry time is not more than about 30 minutes, and preferably not more than about 10 to about 30 minutes. In an important aspect, the alkyd/latex blends of the present invention are effective for use as primers that can be recoated with a wide variety of topcoats, including solventborne topcoats.

In one aspect, the present invention is directed to an alkyd dispersion made from a process effective for providing a stable water dispersion of alkyd polymer that is substantially free of emulsifiers. The aqueous dispersions of the invention have less than about 2 weight percent

organic solvent, at least about 30 weight percent solids, and a viscosity of less than about 20.0 poise at about ambient temperature. In an important aspect of the invention, processing temperatures are minimized, mean  
5 particle size of the resins in the dispersions are kept to size of not more than about 300 nm and the dispersion process is inversionless.

In accordance with the dispersion process used to make aqueous dispersions of alkyds, an ionic functional alkyd  
10 polymer is synthesized in a hydrophilic organic solvent, or synthesized neat and subsequently mixed with hydrophilic organic solvent. In an important aspect of the invention, the alkyd polymer which is formed has an acid value of at least about 4; but the acid value of the polymer which  
15 results from the condensation reaction to make the alkyd is not more than about 40 and has a solubility of at least about 50 weight percent in the hydrophilic solvent, based on the weight of the polymer and solvent, and the hydrophilic solvent has a solubility in water of at least about 5 weight  
20 percent, at processing temperatures, based on the weight of the solvent and water mixture. In connection with the acid value of the alkyd or a hybrid of the alkyd (such as an acrylated alkyd), the acid value of fully converted monomers into a polymer at each stage of polymerization does not  
25 exceed about 40. Hence if the alkyd is an acrylated alkyd, the alkyd portion of the polymer has an acid value of not more than 40 and the acrylated portion of the polymer also has an acid value of not more than about 40. This is important because the water resistance of the coating  
30 deteriorates if the acid value is more than about 40.

After the alkyd polymer is fully dissolved in the organic solvent, an amount of neutralizer is added effective for providing a dispersion of the polymer upon addition of water and removal of solvent. The neutralizer may be any  
35 salt-forming base compatible with the ionizable functional polymer such as sodium hydroxide or an amine. In a very important aspect the neutralizer is an amine type which is

selected from the group consisting of ammonia, triethanol amine, dimethyl ethanol amine, and 2-amino-2-methyl-1-propanol. Not all of the ionizable groups on the polymers need to be reacted with the base (or neutralized).

- 5        Depending on the type of ionizable groups present in the alkyd polymer it may be important that the alkyd polymer is neutralized before it is blended with water so that water dispersible neutralized ionizable groups are distributed throughout the polymer, and in an important aspect, are
- 10      generally evenly distributed throughout the alkyd polymer. After the formation of the polymer salt solution in the hydrophilic organic solvent, and mixing that solution with water to form a water/organic solvent/polymer salt blend, organic solvent and water are removed or stripped from the
- 15      blend at a duration, temperature and pressure effective for providing an aqueous dispersion having a resin mean particle size of not greater than about 300 nm, a polymer concentration of at least about 30 weight percent and an organic solvent concentration of less than 2 weight percent.
- 20      In an important aspect, where the neutralizer is an amine or ammonia, the mean particle size of the resin is maintained with a stripping temperature of not more than about 65°C at a pressure which permits such a stripping temperature.

- In the final step of the process of the invention where
- 25      the hydrophilic solvent is removed from the water/organic solvent/polymer salt blend, there is a steady small increase in viscosity without inversions due to the increase in non-volatile materials (NVM). Nevertheless, no viscosity spike is observed during processing. Inversions should be avoided
- 30      because they will cause high processing viscosities. High processing viscosities will cause use of energy or heat (such as from applying high shear to maintain mixing), or in the alternative, will cause the use of large relative amounts of water or organic solvent which will cause
- 35      disposal problems which increase processing costs and also increase raw material costs because the processing aids are ultimately disposed of.



It also should be recognized as important that the organic solvent is removed such that inversions do not take place during the strip of the organic solvent. With the elimination of inversions during processing, the viscosity of the system remains in the range of about 0.1 poise to about 20 poise (measured at a temperature of about 25°C.), and preferably about 1 to about 20 poise, throughout the process, and a high viscosity spike normally attributed to dispersion processes does not occur. Because a high viscosity spike is never encountered during processing of the dispersion, a higher solids contents can be achieved. In a very important aspect of the invention, at 25°C the dispersion will generally have a viscosity of less than about 10 poise.

In the alternative, the temperature of the strip is below the temperature at which substantial loss of neutralizer would otherwise occur. The mean particle size of the resin does not exceed more than about 300 nm, with a typical mean particle size range of about 40 nm to about 200 nm.

In an important aspect of the invention, polymers which can be dispersed in accordance with the present invention include alkyd polymers and alkyd hybrids. The alkyd polymers being dispersed are generally homogeneous polymers, that is generally one type of alkyd polymer.

In an important aspect of the invention where the dispersion includes an alkyd polymer the solids levels may be at least about 40 weight percent. In the aspect of the invention directed to alkyd polymers, the resins have a number average molecular weight ( $M_n$ ) of about 2,000 to about 10,000 and an acid value of at least about 4, but not more than about 40 as described above. The alkyd has a  $M_n$  of about 2,000 to about 10,000 and an acid value of at least about 4. In a very important aspect, where the -COOH is the ionizable group, the acid value is about 10 to 40, preferably about 15 to about 25. In another aspect of the invention, the polymer being dispersed in accordance with

the invention is a hybrid between a condensation polymer and an addition polymer. In an important aspect, when the dispersion includes a hybrid polymer, the solids level of the dispersion may be at least about 30 weight percent, and preferably from about 30 to about 50. In the aspect of the invention directed to hybrid polymers, the hybrid polymers have a number average molecular weight of at least about 2,000 and an acid value of at least about 4, but not more than about 40 as described above.

In an important aspect, the invention provides formulated coatings that include aqueous polymer dispersions of the alkyd polymer and/or hybrid alkyd polymer described herein, a latex, and optionally a drier selected from the group consisting of cobalt, manganese, vanadium, and rare earth salts of organic carboxylic acids, 1,10-phenanthroline, and mixtures thereof. In a very important aspect, the aqueous alkyd polymer dispersions included in the alkyd/latex blend are carboxyl functional alkyd resins with a number average molecular weight of about 2,000 to about 10,000 and an acid value of from about 10 to about 40.

#### DETAILED DESCRIPTION OF THE INVENTION

##### Definitions

"Polymeric vehicle" means all polymeric and resinous components in the formulated coating, i.e., before film formation, including but not limited to the water dispersible salt of a polymer. The polymeric vehicle may include a cross-linking agent.

"Coating binder" means the polymeric part of the film of the coating after solvent has evaporated, and with a thermosetting polymeric vehicle after cross-linking.

"Formulated coating" means the polymeric vehicle and solvents, pigments, catalysts and additives which may optionally be added to impart desirable application

characteristics to the formulated coating and desirable properties such as opacity and color to the film.

The term "aqueous medium" as used herein means water and a mixture of water and hydrophilic organic solvent in which the content of water is at least 10% by weight.

Examples of hydrophilic solvents include alkylalcohols such as isopropanol, methanol, ethanol, n-propanol, n-butanol, secondary butanol, tert-butanol and isobutanol, ether alcohols such as methyl cellosolve, ethyl cellosolve, propyl cellosolve, butyl cellosolve, methyl carbitol and ethyl carbitol, ether esters such as methyl cellosolve acetate and ethyl cellosolve acetate, dioxane, dimethylformamide, diacetone alcohol, methyl ethyl ketone, acetone, and tetrahydrofurfuryl alcohol.

"Ionizable group" refers to functional groups on the polymer that effect water dispersibility of the polymer. Examples of ionizable groups include -COOH, -SO<sub>3</sub>H, -PO<sub>4</sub>H<sub>2</sub>, and mixtures thereof.

"Neutralizer" refers to compositions which can react with ionizable groups on the polymer to affect water dispersibility. Examples of neutralizers useful in the present invention include amines, ammonia, and metal hydroxides including NaOH and KOH. In an important aspect of the invention, the neutralizers are amines and ammonia.

"Cross-linker" means a di- or polyfunctional substance whose functional groups are capable of forming covalent bonds.

As used herein, the reaction product of an amine or ammonia with a carboxyl group produces a "salt".

"Substantially solventless" means a polymeric vehicle or formulated coating composition having not more than about five weight percent organic solvent.

"Solvent" means an organic solvent.

"Organic solvent" means a liquid which includes but is not limited to carbon and hydrogen which liquid has a boiling point in the range of not more than about 250°C at about one atmosphere pressure.

"Hydrophilic solvent" means a solvent that has a solubility in water of at least about 5 weight percent.

"Volatile organic compounds" (VOCs) are defined by the U.S. Environmental Protection Agency at 40 C.F.R. 51.000 of the Federal Regulations of the United States of America.

A "high solids" or "high solids formulated coating composition" when referring to an aqueous formulated coating composition, means a composition containing more than about 30 percent calculated volume solids, and in an important aspect of the present invention, about 35 percent to about 50 percent calculated volume solids. "Film" is formed by application of the formulated coating composition to a base or substrate, evaporation of solvent, if present, and cross-linking if necessary.

"Air dried formulated coating composition" means a formulated coating composition that produces a satisfactory film without heating or baking, but which provides a satisfactory film at ambient temperature with or without oxidative cross linking.

"Baked formulated coating composition" means a formulated coating composition that provides optimum film properties upon heating or baking above ambient temperature, which composition may include cross linking agents such as melamines.

"Dispersion" in respect to a polymeric vehicle, formulated coating composition, or components thereof means that the composition must include a liquid and particles detectable by light scattering.

"Dissolved" in respect to a polymeric vehicle, formulated coating composition or components thereof means that the material which is dissolved does not exist in a liquid in particulate form where particles larger than single molecules are detectable by light scattering.

"Soluble" means a liquid or solid that can be partially or fully dissolved in a liquid. "Miscible" means liquids with mutual solubility.

"Acid number" or "acid value" means the number of

milligrams of potassium hydroxide required for neutralization of or reaction with ionizable groups present in 1 g of material, such as resin.

"Hydroxyl number" or "hydroxyl value" which is also called "acetyl value" is a number which indicates the extent to which a substance may be acetylated; it is the number of milligrams of potassium hydroxide required for neutralization of the acetic acid liberated on saponifying 1 g of acetylated sample.

"Thermosetting polymeric vehicle" is a polymeric vehicle which irreversibly cross-links for a coating binder to form a film.

"Substantially free of emulsifier" means a composition with not more than about 0.5 weight percent emulsifiers.

Aqueous dispersions of the present invention are substantially free of emulsifier.

As used herein the term "inversion" refers to a phase change where a mobile phase becomes a dispersed phase. For example, an inversion takes place when sufficient oil is added to an oil in water phase such that phases invert to change from a oil in water phase to a water in oil phase. In an "inversionless" system, the corresponding increase in viscosity associated with dispersions does not occur. In an important aspect of the present invention, the viscosity of the system during processing remains less than about 20 poise, and in a very important aspect, less than about 10 poise at 25°C.

As used herein, ~~the~~ latex refers to a polymer made by free radical emulsion polymerization which results in an aqueous dispersion that is stabilized with sufficient levels of surfactant. Commercial examples of latexes include Aquamac® 440, Aquamac® 500, and Aquamac® 580 (all available from McWhorter Technologies).

As used herein, a ~~the~~ universal primer refers to a primer that can be topcoated with virtually any type of topcoating, both solventborne and waterborne, one and two components. Further, a universal primer can be topcoated at any time

after the primer flashes off, with no evidence of lifting or loss of adhesion (to substrate or intercoat). A universal primer can also be topcoated with good enamel holdout. The following limitations exist when using currently available universal primers.

Universal Primer Resin Type	Lift Window	ASTM D3359 Intercoat Adhesion	ASTM D3359 Adhesion to Substrate	Enamel Holdout
Phenolic Modified	No	fair	fair	fair
Epoxy Ester	Yes	good	excellent	good
Latex	swells	fair	good	fair
chlorinated	No	good	good	good

Chlorinated resins work as universal primers, but are limited in desirability due to high costs and the environmental concerns associated with chlorinated resins. A good universal primer according to the invention has no lift window, good intercoat adhesion, good adhesion to substrate and enamel holdout is fair to good.

#### PREPARATION OF ALKYD DISPERSION

##### Stage One: Preparation of Alkyd Resin

In accordance with stage one of the present invention, an alkyd polymer is synthesized neat or in an organic hydrophilic solvent which has limited to infinite solubility in water. Polymers useful in the present invention include generally homogenous alkyds having a number average molecular weight of about 2,000 to about 10,000, preferably a number average molecular weight of 2,000 to 6,000, and alkyd hybrid polymers having a molecular weight of at least about 2,000. In this aspect of the invention, alkyds are synthesized neat and then dropped into solvent. In an important aspect of the invention, the alkyd polymers have an acid value of not more than about 40 as described above,

and in a very important aspect, where the ionizable groups are -COOH, about 10 to about 40, preferably 15 to 25. In a very important aspect of the invention where the ionizable group is derived from SSIPA (5-(sodiosulfo) isophthalic

5 acid), the acid value may be as low as about 4.

Minimization of acid values leads to improved film properties such as corrosion resistance, humidity resistance, and early water resistance. The low acid values of the alkyds are important not only to the aqueous

10 dispersions of the alkyds, but also to the aqueous blends of alkyd and latex polymers. In the prior art it has been known to achieve stable dispersions by blending two

polymers. One of these polymers may have high acid value, and one with a low acid value to obtain a stable/core shell

15 particulate blend with the hydrophillic ionizable groups forming the outer shell of the polymer and a polymer without carboxyl or ionizable groups forming a ~~core~~ of the particulate polymer. As described above, the acid value of

the fully converted monomers into a polymer at each stage of  
20 polymerization does not exceed about 40. Hence if the alkyd is an acrylated alkyd, the alkyd portion of the polymer has an acid value of not more than about 40 and the acrylated portion of the polymer also has an acid value of not more than about 40. This is important because if or when the

25 polymer curls or otherwise forms a particle it does not exhibit a high density of ionizable groups which will reduce the water resistance of the resulting coating. While not intending to be bound by any theory, even with the small particles formed by the particulate alkyd polymer, the  
30 particles formed by the alkyd do not exhibit a charge density of more than about  $4 \times 10^{-5}$  moles of carboxylic acid groups per  $m^2$ .

In another important aspect of the invention, the alkyd polymers are blended with or synthesized in a solvent  
35 selected from the group consisting of alkylalcohols such as isopropanol, methanol, ethanol, n-propanol, n-butanol, secondary butanol, tert-butanol and isobutanol, ether

alcohols such as methyl cellosolve, ethyl cellosolve, propyl cellosolve, butyl cellosolve, methyl carbitol and ethyl carbitol, ether esters such as methyl cellosolve acetate and ethyl cellosolve acetate, dioxane, dimethylformamide, 5 diacetone alcohol, methyl ethyl ketone, acetone, and tetrahydrofurfuryl alcohol. The polymers of the invention have a solubility at processing temperatures in the hydrophilic solvent of at least about 50 weight percent, more preferably at least about 80 weight percent, based on 10 the total weight of the composition.

Stage one provides an alkyd resin in a hydrophilic solvent which can be stored, and which can be further processed in stage two.

#### 15 Alkyd

In the aspect of the invention where alkyds are used, the alkyd polymer has a  $M_n$  of about 2,000 to about 10,000, preferably about 2,000 to about 6,000. In the aspect of the invention where -COOH is the ionizable group, the acid value 20 is about 10 to about 40, preferably an acid value of about 15 to about 25, and where the ionizable group(s) includes -SO<sub>3</sub>H, and/or phosphate (-PO<sub>4</sub>H<sub>2</sub>) the acid value can be as low as about 4.

An alkyd resin is an oil modified polyester resin and 25 broadly is the product of the reaction of a di- or polyhydric alcohol and a di- or poly- basic acid or acid derivative in the presence of an oil, fat or carboxylic acid derived from such oil or fat which acts as a modifier. Such modifiers are typically drying oils which can be added at a 30 high level of modification (long oils) or as a small level of modification (short oils).

The dihydric or polyhydric alcohol employed is suitably an aliphatic alcohol; suitable alcohols include triols and tetraols such as trimethylolpropane, trimethylolethane, 35 tris(hydroxyethyl) isocyanurate, glycerine, and pentaerythritol, and dihydric alcohols or diols that may include neopentyl glycol, dimethylol hydantoin, ethylene



glycol, propylene glycol, 1,3-butylene glycol, diethylene glycol, dipropylene glycol, 1,4-cyclohexane dimethanol, Esterdiol 204 (trademark of Union Carbide), 1,3-propane diol, 1,6-hexanediol, and dimethylol propionic acid (DMPA).

- 5 As can be seen from the reference to DMPA, polyhydric alcohols may have -COOH groups. Mixtures of the alcohols may also be employed, particularly to provide a desired content of hydroxyl groups.

- The dibasic or polybasic acid, or corresponding  
10 anhydrides employed may be selected from a variety of aliphatic and aromatic carboxylic acids. Suitable acids and acid anhydrides include, by way of example, adipic acid, phthalic anhydride, isophthalic acid, bis 3,3',  
15 4,4'-benzophenone tetracarboxylic anhydride, and trimellitic anhydride. Mixtures of the acids may also be employed, particularly to provide a desired content of carboxyl groups.

## 20 Hybrid Polymers

- In another aspect of the invention, the alkyd polymers or resins that can be dispersed in accordance with the present invention may include polymers which are hybrids of alkyd polymers and other polymers. The hybrid polymers may  
25 be any combination of one or more alkyd polymer and one or more addition polymers which combination has an acid value within the aforesaid range and a number average molecular weight of at least about 2,000. In an important aspect, the hybrid polymers, are alkyds which also include acrylated  
30 portions. The acrylated portions, however, do not exceed about 20 weight percent of the entire polymer. Moreover, as generally described above, no portion or segment of the hybrid has an acid value of more than about 40. Examples of hybrid resins are described in Padgett, "Polymers for Water-  
35 Based Coatings - A Systemic Overview," Journal of Coatings Technology, 66:89-105 (1994), which is hereby incorporated by reference. Hybrid polymers also include epoxy modified

alkyds, styrene modified alkyds, and vinyl toluene modified alkyds.

### Stage Two: Resin Dispersion

5

#### Neutralizing The Resin

In an important aspect of the invention, the alkyd polymer salt is formed in situ in the organic solvent with water being mixed with the polymer salt/organic solvent combination. In accordance with the invention, neutralizer is added to an organic solvent solution containing the resin in an amount effective for neutralizing the resin to provide sufficient salt to render the resin dispersible in water. Neutralizers useful in the present invention include but are not limited to ammonia, triethanol amine, dimethyl ethanol amine, 2-amino-2-methyl-1-propanol, NaOH and KOH.

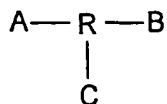
The amount of neutralizer added is dependent on chemistry type, acid value and molecular weight. In one aspect, where the ionizable group is carboxyl, from about 30 to about 70 percent of the carboxyl groups are neutralized to obtain the solids level and low VOC level of the dispersions of the invention, but all of the carboxyl groups may be neutralized. In another important aspect, neutralizer is mixed with the alkyd polymer in an amount effective to provide at least about 70 parts polymer salt in less than about 30 parts solvent wherein with subsequent mixing with water, the neutralized polymer will provide a dispersion which comprises not more than about 60 weight percent water, based on the weight of the dispersion. In a very important aspect of the invention, where the ionizable group is carboxyl the alkyd requires between about 60% to about 100% neutralization to stabilize the dispersion.

In another important aspect of the invention, the process provides a mean particle size of not more than about 300 nm, with a typical mean particle size in the range of about 40 nm to about 200 nm as measured by laser light scattering.

The alkyd polymer can be preneutralized by making the polymer metal, amine or ammonia salts of the monomer's ionizable groups such as  $-\text{COOH}$ ,  $-\text{SO}_3\text{H}$ ,  $-\text{PO}_4\text{H}_2$ , and mixtures thereof. The polymer made from these "preneutralized"

- 5 monomers would have an acid value, as measured by titration, of at least about 4 and not more than about 40 as described above if the ionizable groups which form part of the polymer were not already neutralized. In this aspect of the invention, monomers have a polyfunctionality such as a  
10 difunctionality which permits them to form polymers that also have the salt form of the ionizable groups.

An example of such a monomer is



where A and B are  $-\text{OH}$  and/or  $-\text{COOH}$  which can form a

- 15 polyester in a condensation reaction and C is selected from the group consisting of  $-\text{COOX}$ ,  $-\text{SO}_3\text{X}$  and  $-\text{PO}_4\text{Y}_2$ , where X is an alkali metal such as sodium or potassium and one Y may be H, but at least one or both Ys are alkali metals such as sodium or potassium.

- 20 Alkyd polymers can be made with 5-(sodiosulfo) isophthalic acid which would result in condensation polymers which are condensed through the carboxyl groups of the acid with free  $-\text{SO}_3\text{Na}$  groups. The same could be done with 5-(potassiosulfo) isophthalic acid. When neutralized polymers  
25 are made in this way, the neutralized polymer should be soluble in the hydrophilic solvent, and in an important aspect, the neutralized polymer is at least 50 weight percent soluble in the hydrophilic solvent. In an important aspect, when  $-\text{SO}_3\text{H}$  is included as an ionizable group, as low  
30 as about 10 percent of the ionizable groups may be neutralized to obtain the solids level and low VOC level of the dispersions of the invention.

Addition of Water

In the next step of stage two of the process, water having a temperature of about 25°C. to about 65°C. is added to the neutralized resin solution. In an important aspect of the invention, the initial ratio of solvent to water is about 1 to about 3.5 for alkyd polymer. The initial ratio of solvent to water is important to ensure that inversion does not take place during subsequent stripping of solvent. The amount of water to be added may be greater than that required to obtain the desired solids of the final dispersion. Some water loss typically occurs during solvent distillation. The system requires sufficient solvent at the beginning to solubilize the salt prior to water addition.

In an alternative aspect of the invention, polymer in hydrophilic solvent is added to water that already contains a neutralizer.

Removal of Solvent

In the next step of the process, the organic solvent and water if required are removed or stripped from the neutralized resin/water/solvent mixture. A reduced atmospheric pressure may be applied to the mixture to aid in the removal of solvent and water. In an important aspect, vacuum may range from about 22 inches to about 29 inches of mercury gauge. With lower temperatures, a higher vacuum must be used to remove solvent. Lower reaction temperatures result in less foaming, as the higher vacuum coupled with the surface tension of the bubbles helps to break the bubbles. In another aspect of the invention, solvent/water is stripped with heat being supplied through the use of a heat exchanger. Use of a heat exchanger may reduce distillation times and temperatures and further minimize destruction of the salt. In a very important aspect of the invention, solids levels of at least about 40 weight percent to about 50 weight percent can be attained for alkyds. In another aspect of the invention, solvent that is removed can be purified and reused. A simple flash or multiple

stage distillation is sufficient to clean the solvent of any contamination.

The water dispersion of the alkyd polymers does not require emulsifying agents and does not have more than about 5 2 weight percent, based on the weight of the composition, of organic solvent after the distillation of the solvent. In an important aspect, the aqueous dispersion contains from about 0.2 to about 2 weight percent organic solvent.

10 The water dispersion of the alkyd polymers includes the alkyd polymers, as well as the water dispersible amine salt of the alkyd polymer. In the aspect of the invention where the ionizable group is a carboxyl, the aqueous dispersion of the invention does not have less than 30 percent of the free carboxyl groups of the polymer neutralized or converted into 15 a salt. As the acid number of the polymer goes down, the higher the percent of the carboxyl groups on the polymer must be neutralized. Where the ionizable groups are -COOH, to maintain the dispersion below an acid value of about 15, about 100% of the carboxyl groups on the polymer should be 20 neutralized to the salt. In an important aspect of the invention, about 100% of the carboxyl groups on the polymer are neutralized to the salt and the dispersions of the invention do not have more than about 1 pound per gallon of dispersion (120 g/l) VOCs, and in a very important aspect 25 the dispersion has about 0.2 pounds per gallon of dispersion VOCs.

#### PREPARATION OF ALKYD DISPERSION/LATEX BLENDS

30 In this aspect of the invention, alkyd dispersions prepared according to the present invention are useful for blending with latex. The resulting blend is effective for use as a universal primer, especially when the blend comprises from about 30 to about 50 weight percent latex based upon the weight of the total resin solids in the 35 aqueous blend. In an important aspect, the latex is made from styrene and acrylic monomers which provides a styrenated acrylic latex

In an important aspect of the invention, the aqueous dispersions of the salts of the carboxyl functional alkyd resins with a number average molecular weight of about 2,000 to about 10,000, preferably about 2,000 to about 6,000, 5 having an acid number of about 15 to about 25, having less than about 2% volatile organic solvent at about 30 to about 50% solids in water and a mean particle size of about 40 to about 300nm are blended with latex.

Formulation of blends of alkyd dispersions and latex 10 provide a film coating with a humidity resistance of at least about 336 hours, an air dry time of about 10 to about 40 minutes, and a salt spray corrosion resistance of at least about 336 hours. In a very important aspect, the primer coatings of the present invention can be recoated 15 with a wide variety of topcoats. Examples of topcoats that can be used over the primers of the invention include coatings made from the following: conventional solventborne alkyds, high solids solventborne alkyds, two component acrylic urethanes, solventborne polyester bakes, water 20 reducible alkyds, and latexes.

The following examples illustrate methods for carrying out the invention and should be understood to be illustrative of, but not limiting upon, the scope of the 25 invention which is defined in the appended claims.

**EXAMPLE 1: ALKYD DISPERSION****Synthesis of an Alkyd Polymer:**

- 5 1. 605 grams of Pamolyn 200 (Hercules) was charged to a round bottom flask equipped with a packed column, receiver, and nitrogen blanket.
- 10 2. The flask was heated to 130 degrees centigrade and 727 grams of trimethylolpropane (TMP), 20 grams of palmitic acid, 15 grams of stearic acid, 88 grams of benzoic acid (BA), 686 grams of isophthalic acid (IPAc) and 0.45 grams of FASCAT 4100 (Elf AtoChem) were added with mixing.
- 15 3. The temperature was steadily and gradually increased to 220 degrees centigrade and waters of esterification were removed.
- 20 4. When the acid value was 4.8, the temperature was reduced to 170 degrees centigrade and the mode of operation was switched to a straight total condenser.
- 25 5. 176 grams of trimellitic anhydride (TMA) was added to the flask and the temperature was maintained at 170 degrees centigrade.
- 30 6. Waters of esterification were removed until an acid value of 25.6 was reached.
- 35 7. The temperature was reduced to 140 degrees centigrade and the polymer was transferred to a flask containing isopropanol (IPA).

## PROPERTIES OF THE ALKYD SOLUTION:

	Percent Solids	(NVM)	about 70%
	Acid Value	(AV#)	about 25
5	Molecular Weight	(Mn)	about 3200
	Viscosity	(cps)	about 7200

## Preparation of Alkyd Dispersion

- 10 1. 1700 grams of an alkyd solution in isopropanol (IPA)  
was charged to a round bottom flask equipped with a  
simple condenser and receiver.
2. The flask was heated to 50 degrees centigrade with mild  
15 mixing.
3. Upon reaching temperature, 42 grams of triethylamine  
(TEA) was added directly into the flask and mixed for  
15 minutes.
- 20 4. 2000 grams of water was then added over  $\frac{1}{2}$  hour. After  
all of the water was added, mixing was continued for an  
additional  $\frac{1}{2}$  hour.
- 25 5. Vacuum was applied to the flask and slowly increased to  
a maximum of 29 inches of mercury. The temperature of  
the flask was maintained at 50 degrees centigrade.
6. Vacuum continued until 565 grams of distillate was  
30 removed. At no time during the vacuum step was there  
any viscosity spike observed.
7. After the desired amount of distillate was obtained,  
the vacuum was broken and the resulting product  
35 analyzed.



## PROPERTIES OF THE ALKYD DISPERSION:

Percent Solids	(NVM)	30.8%
Viscosity	(cps)	355

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EXAMPLE 2: FORMULATION OF AN ALKYD DISPERSION PRIMER  
PAINT

A dispersed alkyd resin produced in a manner similar to  
10 that in Example 1 was formulated into a paint as follows:

1. 100 grams of deionized water was placed in a 1  
liter stainless steel mixing vessel.

2. The following ingredients were added to the  
vessel:

15 1 gram of Bentone LT (Rheox)  
5 grams Byk 020 (Byk-Chemie)  
25 grams CT-131 (Air Products)  
1 gram Rheolate 255 (Rheox)  
65.8 grams SZP-391 (Halox)  
20 197.4 grams R-706 (DuPont)  
105.2 grams Imsil A-10 (Unimin)

The mixture was dispersed for 10 minutes, using an Eiger  
Mill with 400 grams of 3 mm glass beads.

3. The mixer was then slowed to blending speed. An  
25 addition of the following blend was added to the vessel:

800 grams alkyd dispersion

The next two items were premixed before addition  
to the vessel:

30 7.8 grams Cobalt Hydro-Cure (OM Group)  
7.8 grams deionized water  
25.0 grams of 4% solution of sodium nitrite  
1.4 grams Rheolate 255 (Rheox)  
57.8 grams deionized water

35 The alkyd dispersion contains an alkyd with a molecular  
weight of 2800 and an acid value of 25, resulting in a  
monomodal particle size of 86 nm (median)  $\pm$  21 nm, 85 nm

(mode) and a pH of 6.79.

The resulting paint had a viscosity of 38 seconds in a #2 Zahn cup, and was applied to matte cold rolled steel panels through a conventional siphon air spray gun.

5 Calculated VOC was approximately 24 grams per liter.

### EXAMPLE 3: FORMULATION OF AN ALKYD DISPERSION/LATEX BLEND PRIMER PAINT

A dispersed alkyd resin produced in a manner  
10 similar to that in Example 1 was formulated into a paint as follows:

1. 100 grams of deionized water was placed in a 1 liter stainless steel mixing vessel.

2. The following ingredients were added to the  
15 vessel:

1 gram Rheolate 255 (Rheox)  
65.8 grams SZP-391 (Halox)  
197.4 grams R-706 (DuPont)  
105.2 grams Imsil A-10 (Unimin)

20 The mixture was dispersed for 10 minutes, using an Eiger Mill with 400 grams of 3 mm glass beads.

3. The mixer was then slowed to blending speed. An addition of the following blend was added to the vessel:

The first two items were premixed before addition  
25 to the vessel:

7.8 grams Cobalt Hydro-Cure (OM Group)  
7.8 grams deionized water  
25.0 grams of 4% solution of sodium nitrite  
1.4 grams Rheolate 255 (Rheox)  
30 57.8 grams deionized water

4. Blends of dispersion and latex were made using the following chart where

35 latex 1 = Aquamac® 440 (McWhorter)  
latex 2 = Aquamac® 750 (McWhorter)  
latex 3 = Maincote® HG-54 (Rohm & Hass)

	a	b	c	d	e	f	g	h	i	j	k
	100% alkyd	30% latex 1	50% latex 1	70% latex 1	100% latex 1	30% latex 2	50% latex 2	70% latex 2	30% latex 3	50% latex 3	70% latex 3
alkyd dispersion	400 grams	280 grams	200 grams	120 grams		280 grams	200 grams	120 grams	280 grams	200 grams	120 grams
latex		106 grams	176 grams	248 grams	356 grams	106 grams	176 grams	248 grams	106 grams	176 grams	248 grams

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## Properties of the paint

The panels prepared above were allowed to cure for 7 days at ambient conditions. The panels were then subjected to Cleveland humidity testing, salt spray (scribed and unscribed), and water immersion. Corresponding ASTM test numbers were as follows.

	Test	ASTM Numbers
10	Humidity	D4585
	Salt Fog	B117
	Water Immersion	D870@72°F, uncirculated water

15 The results were as follows.

	a	b	c	d	e	f	g	h	i	j	k
Results at 336 hours	100% alkyd	30% latex 1	50% latex 1	70% latex 1	100% latex 1	30% latex 2	50% latex 2	70% latex 2	30% latex 3	50% latex 3	70% latex 3
Humidity	6VD	8VF	10	rust 8F	10	8MD	8F	holes 10	8F	rust 8VF	rust 6MD
Scribed Salt Spray	8MD	4F	3F	3F	4MD	8VF	4M	4MD	2M	2M	2D
Un-scribed Salt Spray	8MD	8M	7F	4M	NT*	4F	8M	4MD	3MD	2MD	2D
Water Immersion	8D	10	10	10	NT*	9VF	10	8MD	10	rust 8M	rust 8M

\*Not Tested  
Shaded areas represent unacceptable properties..

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**EXAMPLE 4; FORMULATION OF AN ALKYD DISPERSION/LATEX BLEND  
PRIMER PAINT**

A dispersed alkyd resin produced in a manner similar to that in Example 1 was formulated into a paint as .

5 follows:

1. 131 grams of alkyd dispersion were placed in a 1 liter stainless steel mixing vessel.

2. The following ingredients were added to the vessel:

- 10 0.6 gram of Bentone LT (Rheox)  
1.2 grams Byk 020 (Byk-Chemie)  
3.3 grams CT-131 (Air Products)  
0.3 grams Byk 302 (Byk-Chemie)  
21.2 grams SZP-391 (Halox)  
15 3.9 grams of Raven 1250 (Colombian)  
85.1 grams Imsil A-10 (Unimin)

The mixture was dispersed for 10 minutes, using an Eiger Mill with 400 grams of 3 mm glass beads.

3. The mixer was then slowed to blending speed. An  
20 addition of the following blend was added to the vessel:

52.6 grams alkyd dispersion

The next two items were premixed before addition to the vessel:

- 25 2.6 grams Cobalt Hydro-Cure (OM Group)  
2.6 grams deionized water  
69.6 grams Aquamac® 440 (McWhorter)

The alkyd dispersion and latex blend (Aquamac® 440) was tested as a universal primer with the following general  
30 results.

35

	Resin Type	Lift Window	Intercoat Adhesion	Adhesion to Substrate	Enamel Holdout
	Alkyd Disp.	Yes	good	good	fair
5	Alkyd/ Latex 70/30	No	good	good	good
10	Alkyd/ Latex 50/50	No	good	good	fair
	Latex	Swells	good	good	poor

Numerous modifications and variations in practice of  
the invention are expected to occur to those skilled in the  
art upon consideration of the foregoing detailed description  
of the invention. Consequently, such modifications and  
variations are intended to be included within the scope of  
the following claims.

## WHAT IS CLAIMED IS:

1. An aqueous blend comprising:  
an aqueous dispersion of a neutralized salt of an alkyd  
5 polymer; and  
at least about 10 weight percent, based on the total  
weight of resin solids of the blend, of a latex, wherein the  
blend is effective for providing a film coating with a  
humidity resistance of at least about 336 hours, an air dry  
10 time of from about 10 to about 40 minutes at about 25°C, and  
a salt spray corrosion resistance of at least about 336  
hours.
2. An aqueous blend according to claim 1 wherein the  
15 alkyd polymer prior to neutralization has an acid value of  
from about 10 to about 40, a number average molecular weight  
in the range of from about 2,000 to about 10,000, and a mean  
particle size of not more than about 300 nm.
- 20 3. An aqueous blend according to claim 2 wherein the  
acid value of the alkyd polymer does not exceed about 40.
4. An aqueous blend according to claim 3 wherein the  
alkyd polymer includes sufficient -COOH groups to provide an  
25 acid value of at least about 10 prior to neutralization.
5. An aqueous blend according to claim 3 wherein the  
alkyd polymer includes sufficient -SO<sub>3</sub>H groups to provide an  
acid value of at least about 4 prior to neutralization.  
30
6. An aqueous blend according to claim 3 wherein the  
alkyd polymer is a hybrid polymer selected from the group  
consisting of epoxy modified alkyds, acrylic modified  
alkyds, styrene modified alkyds, vinyl toluene modified  
35 alkyds, and mixtures thereof.



7. An aqueous blend according to claim 1 wherein the aqueous blend is effective for use as a universal primer.

8. An aqueous blend according to claim 3 wherein the alkyd is formed by a condensation reaction of monomers and the acid value of fully converted monomers into an alkyd at each stage of polymerization does not exceed an acid value of about 40.

9. An aqueous primer composition formed by a process comprising:

blending an alkyd dispersion with a latex to provide the aqueous primer,

the aqueous primer comprising at least about 10 weight percent latex, based on the weight of resin solids of the aqueous primer and wherein the aqueous primer is effective for providing a film coating with a humidity resistance of at least about 336 hours, an air dry time of from about 10 to about 40 minutes at 25°C, and a salt spray corrosion resistance of at least about 336 hours.

10. An aqueous primer composition according to claim 9 wherein an alkyd dispersion is made by forming an alkyd polymer having sufficient -COOH groups to provide the alkyd with an acid value of about 10 to about 40, forming a solution of the alkyd polymer in an organic hydrophilic solvent, wherein the polymer has a solubility in the organic hydrophilic solvent of at least about 50 weight percent, and the organic hydrophilic solvent has a solubility in water of at least about 5 weight percent;

neutralizing at least about 30 percent of the -COOH groups of the polymer with an amount of neutralizer effective to form a solution of neutralized polymer salt;

mixing the solution of neutralized polymer salt with water to form a blend of water/organic solvent/neutralized polymer; and

stripping the organic from the blend of water/organic solvent/neutralized polymer blend at not more than about

65°C. to form a dispersion of neutralized polymer salt in water,

the alkyd dispersion having less than about 2 weight percent organic solvent, at least about 30 weight percent solids, and a viscosity of less than about 20 poise at a temperature of about 25°C.

11. An aqueous primer composition according to claim 10 wherein the alkyd has a number average molecular weight of about 2,000 to about 10,000 and the alkyd polymer having an acid value which does not exceed about 40.

12. An aqueous primer composition according to claim 10 wherein the neutralizer is selected from the group consisting of sodium hydroxide, potassium hydroxide, ammonia, triethanol amine, 2-amino-2-methyl-1-propanol, and dimethyl ethanol amine.

13. An aqueous primer composition according to claim 10 wherein water is added to the solution of the neutralized polymer in an amount effective to provide an initial ratio of solvent to water of about 1 to about 3.5.

14. An aqueous primer composition according to claim 10 wherein organic solvent is removed without an inversion.

15. An aqueous primer composition according to claim 10 wherein the process is effective for providing a polymer dispersion having a mean particle size of not more than about 300 nm.

16. An aqueous primer composition according to claim 10 wherein the blend includes from about 10 weight percent to about 60 weight percent, based on the total weight of the blend, of a latex.

17. An aqueous primer composition according to claim 10 wherein the alkyd polymer is a hybrid polymer selected

from the group consisting of epoxy modified alkyds, acrylic modified alkyds, styrene modified alkyds, vinyl toluene modified alkyds, and mixtures thereof.

5        18. An aqueous primer composition according to claim  
11 wherein the alkyd is formed by a condensation reaction of  
monomers and the acid value of fully converted monomers into  
an alkyd at each stage of polymerization does not exceed an  
acid value of about 40.

10        19. A process for preparing an aqueous primer  
composition, the process comprising blending an alkyd  
dispersion with at least about 10 weight percent, based on  
resin solids of the blend, of a latex, wherein the blend is  
15 effective for providing a film coating with a humidity  
resistance of at least about 336 hours, an air dry time of  
from about 10 to about 40 minutes, and a salt spray  
corrosion resistance of at least about 336 hours.

20        20. A process according to claim 19 wherein the alkyd  
dispersion is formed by forming an alkyd polymer having  
sufficient -COOH groups to provide the alkyd with an acid  
value of from about 10 to about 40, forming a solution of  
the alkyd in an organic hydrophilic solvent, wherein the  
25 polymer has a solubility in the hydrophilic solvent of at  
least about 50 weight percent, and the organic hydrophilic  
solvent has a solubility in water of at least about 5 weight  
percent;

30        neutralizing at least about 30 percent of the -COOH  
groups of the polymer with an amount of neutralizer  
effective to form a solution of neutralized polymer salt;

      mixing the solution of neutralized polymer salt with  
water to form a blend of water/organic solvent/neutralized  
polymer; and

35        stripping the organic from the blend of water/organic  
solvent/neutralized polymer blend at not more than about  
65°C. to form a dispersion of neutralized polymer salt in  
water.

the dispersion having less than about 2 weight percent organic solvent, at least about 30 weight percent solids, and a viscosity of less than about 20 poise at a temperature of about 25°C.

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21. A process for preparing an aqueous primer according to claim 20 wherein the alkyd has a number average molecular weight of about 2,000 to about 10,000 having an acid value which does not exceed about 40.

10

22. A process for preparing an aqueous primer composition according to claim 20 wherein the neutralizer is selected from the group consisting of potassium hydroxide, sodium hydroxide, ammonia, triethanol amine, 2-amino-2-methyl-1-propanol, and dimethyl ethanol amine.

15

23. A process for preparing an aqueous primer composition according to claim 20 wherein water is added to the solution of the neutralized polymer in an amount effective to provide an initial ratio of solvent to water of about 1 to about 3.5.

20

24. A process for preparing an aqueous primer composition according to claim 20 wherein organic solvent is removed without an inversion.

25

25. A process for preparing an aqueous primer composition according to claim 20 wherein the process is effective for providing a polymer dispersion having a mean particle size of not more than about 300 nm.

30

26. A process for preparing an aqueous primer composition according to claim 20 wherein the alkyd polymer is a hybrid polymer selected from the group consisting of epoxy modified alkyds, acrylic modified alkyds, styrene modified alkyds, vinyl toluene modified alkyds, and mixtures thereof.

35

27. An process for preparing an aqueous primer composition according to claim 21 wherein the alkyd is formed by a condensation reaction of monomers and the acid value of fully converted monomers into an alkyd at each  
5 stage of polymerization does not exceed an acid value of about 40.